Saskatchewan
Environment
and Resource
Management

Fisheries assessment and monitoring in Saskatchewan -

Action Plan

Fish and Wildlife Technical Report 00-2

October 2000

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FISHERIES ASSESSMENT AND MONITORING IN SASKATCHEWAN —

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Saskatchewan Environment and Resource Management

Fish and Wildlife Branch
and
Operations - EcoRegions

EXECUTIVE SUMMARY

Fisheries assessment aims to provide advice on biological populations and ecosystems, and alternatives for management actions. It provides a scientific foundation for society to understand, protect, and manage natural resources.

Saskatchewan has 100,000 lakes and rivers, about half containing sport and commercial fish species. Beginning in the 1950s, lake surveys and studies advanced our knowledge and addressed special concerns. By the 1990s, co-ordination of assessments across the province was weakened, and support of scientific studies was eroded. At the same time, our needs are greater since the focus is less on individual species and more on the complexities of ecosystems.

Fisheries management must address fish habitat, fish populations, sustainable use, access to resources, and compliance with aboriginal rights. Assessments must provide relevant advice which is scientifically sound and contribute to the aquatic components of ecosystem monitoring, with responsible use of staff and funding.

Major objectives outlined in this action plan include:

- Renew data management.
- Provide species and co-ordinated perspectives.
- Address regional and co-management issues.
- Monitor for ecosystem management and ecological health.
- Support initiatives regarding Aboriginal conservation.
- Conduct applied research and develop new methods.

Recommendations in high-priority areas include:

- Renew the ability to maintain and summarize existing data on harvests and users.
- Support the analysis of fisheries data with software tools and technical advice.
- Expand our ability to collect and summarize data on outfitter and other harvests.
- Commit resources to the Canada-wide survey of anglers in 2000.
- Develop guidelines for reliable and suitable assessments.
- Contribute to the departmental program in ecological health indicators.
- Establish and begin monitoring a series of lakes and fisheries.
- Co-operate in assessing and understanding Aboriginal usage of fish.
- Develop new methods of monitoring fish abundance and trends.

Appendixes contain further information on staffing needs within Saskatchewan Environment and Resource Management related to these components, excerpts from other reviews of fisheries assessment, and categories of lakes for ongoing monitoring programs.

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INTRODUCTION

The sphere of "fisheries assessment" is to provide advice for management understanding of biological populations and ecosystems, and alternatives for management action. Assessment provides a scientific foundation for society to understand, protect, and manage natural resources. Fisheries management is a broader activity which considers the issues of fish habitat, conservation of populations, sustainable uses, socio-economic factors, and legal and other issues.

In recent years, there have been some spectacular collapses of important marine and freshwater fish species, and increasing demands for improved understanding and predictions of the status of fish populations. Depletions of fish populations have caused major concern among scientists, fishery managers, the fishing community, and the public.

Reviews of fisheries assessment and research programs have often cited the need for more reliable science, improved biological knowledge, and greater consideration of socio-economics and community aspirations. Recent examples in North America include reports by House of Commons in 1998, National Research Council in 1998, and National Marine Fisheries Service in 1998.

Current Situation

Saskatchewan has 100,000 lakes and rivers, about half of them containing fish species harvested by sport and commercial users. From the 1950s to 1980s, a program of lake surveys and studies advanced the knowledge of lakes, and addressed special concerns. During the 1970s, fisheries assessments increased in the central and northern areas to provide advice on questions of sustainability, economics, and resource allocation. In the 1980s, fisheries management was regionalized and assessments moved towards specific issues of management. By the mid-1990s, the co-ordination of fisheries assessments across the province was weakened, and staff and budgetary support for assessment was eroded.

Recently, natural resource and environment agencies have tried to focus less on single species and more on the interwoven nature of ecosystems. The objectives of society for protection and management have moved from minimal protection and maximum utilization towards reliable, even precautionary, protection and sustainable use (if any).

GOALS

Fisheries management must be designed to fit the values of Saskatchewan society. These include the conservation and protection of fish habitat and populations, sustainable and optimal use, multi-purpose access to resources, and compliance with aboriginal rights.

Fisheries assessment must provide advice on issues which are relevant and useful to our mandate and responsibility for fisheries conservation and management.

The goals are:

- To plan and implement an assessment and monitoring program which is scientifically sound and capable of supporting fisheries conservation and management.
- To contribute to the aquatic and related components of an ecosystem monitoring program, which is presently evolving.
- To establish a plan which can be supported by fisheries staff and co-management groups.

This plan is organized to fit into the departmental "Ecosystem Management Action Plan". It also covers many of the general topics in the report "Fisheries management in Saskatchewan: A strategic plan for the 1990s", such as:
- Inventory, population, and harvest data will be acquired and interpreted.
- Sufficient data about fish, fishing, habitats, and fishermen will be acquired to support management activities.
- Co-operation from stakeholders and resource users will be fostered by:
(a) encouraging them to assist with data collection, analysis, and interpretation;
(b) providing feedback of data and analysis on fish and fisheries.

In this plan, Fish and Wildlife Branch and Operations - EcoRegions intend to participate in planning fisheries assessment and monitoring, in ensuring effective management through the evaluation of data and options, and in implementing provincial and regional actions.

OBJECTIVES

Six major objectives are outlined, with some priorities highlighted.

- Renew data management.
- Provide species and co-ordinated perspectives.
- Address regional and co-management issues.
- Monitor for ecosystem management and ecological health.
- Support initiatives regarding Aboriginal conservation.
- Conduct applied research and develop new methods.

Several conservation and management topics are not considered to belong in this action plan: These include studies of specific habitats (except as predictors of fish communities and productivity), economic surveys (except for the behaviour of sport or commercial users), genetic assessments (except as part of understanding stocks and populations), and legal or user-allocation issues (except for the biological implications of alternatives).

Objective 1: Renew Data Management

Fisheries assessment requires population data, trends in sizes and ages, and other indicators. Co-management with resource users requires compilation and analysis of data they provide, and feedback of interpretations and options. Allocation options may require data on resource users, estimated total harvests, and socio-economic factors for evaluation.

Data management is defined here as data entry, storage, summary, analysis, and distribution of results to users, either from central or decentralized locations.

Timely collection and analysis of data will allow us to support and fulfill other objectives. Data management should be considered a tool or means, rather than an objective. In reality, the ability to maintain and analyze fisheries data has been seriously compromised, and much of this plan will fail without effective data management.

(1) Renewed basics

Issue: Data on commercial harvests and users are available from other agencies, and should be compiled and summarized so that long-term trends are not lost. These records of weekly commercial net fishing harvests are available in electronic format.

Several existing datasets require updating for long-term monitoring and periodic review. These include commercial fishing on 2000 lakes, lake-survey data on 400 lakes, and angler catch/effort and outfitter harvests on more than 100 lakes (from interviews, gut-can counts, campground permits, enforcement interviews, creel surveys).

Issue: Saskatchewan has participated in the Canada-wide survey of anglers every five years. This involves co-operative efforts by provincial staff, with federal co-ordination and analysis. Our participation has occasionally been in doubt, but no other provincial survey of anglers occurs. This program requires a commitment for 2000.

Issue: Support of more routine assessments with software and statistical advice is not available. Consensus on routine analyses, field-data formats, and standard programs are essential since different formats and changes in methods can subvert any efforts.

(2) Expanded ability

Fish populations and fishing activities are usually dispersed across wide areas and several seasons. Assessment requires field collection of data from numerous locations, several types of fishing, and large samples of fish.

Issue: Outfitter usage is based on seasonal allocations by departmental policy. Data on amounts of fish harvested and client numbers is not collected or analyzed at present, so assessments are unknown.

Other data collection projects such as lake surveys, fisheries abundance, and sport and commercial surveys require staff and resources.

Objective 2: Provide Species and Co-ordinated Perspectives

Reviews of species status and management options province-wide will improve understanding and advice to resource managers. These overviews should involve examples of different situations and geographical areas, so that results can be applied generally. Co-ordination of studies ensures that suitable situations are examined, and will also allow interaction with other provincial and federal agencies.

Priorities for review will be set co-operatively through discussions among regional and branch staff. Some proposals for consideration include:
- Guidelines for assessment methods.
- Overviews of high-profile or sensitive species (e.g. walleye and lake trout).
- Modelling fish populations and user behaviour.
- Relationship of habitat indexes to species abundance and communities.

Issue: Guidelines for assessment are needed to outline those alternative methods which are reliable, efficient, and suitable. Guidelines would outline some of the theory and established practices, examples from different situations, sources of data for comparison, and analysis. Evaluating reliability should focus on performance, by emphasizing the results needed and any comparative data available for interpretation, rather than field methods. Evaluating efficiency would consider the staffing and equipment required, and the likelihood of detecting trends using alternative methods.

Overviews and modelling will benefit from information collected during previous surveys. These should focus on long-term fisheries, areas with previous concerns, and existing data-sets. Examples of cases include:

- Large, northern lakes; with lake trout and whitefish community; and several fisheries.
- Smaller, northern lakes; lake trout or whitefish; with previous surveys.
- Medium-size lakes; walleye and pike fisheries; several fisheries.
- Reservoirs; walleye and pike and perch; previous surveys.
- Rivers; goldeye, sauger, and other riverine species; previous surveys.

Objective 3: Address Regional and Co-management Issues

Fisheries assessment must address concerns identified by both fisheries workers and stakeholders who are familiar with situations on specific lakes and populations.

Co-management of resources should involve users in providing data, understanding population trends and management options, and participating in allocation and socio-economic decisions. Biological assessment is part of this process, and requires data collection and analysis, reviews of alternative options, and explanation of results and interpretations.

Issue: Improved data collection for angling and other harvests on individual waterbodies is required for management. There are a variety of methods for surveying anglers and commercial fishers. There is a need is for additional resources to survey these users and/or collect similar data from co-operators.

There are two categories of lakes and fisheries which encompass many of the high-priority situations.

Legacy lakes: These have fisheries with historical importance, based on their subsistence, commercial, or sport use, their economic or cultural importance, and recurrent issues of sustainability and allocation.

High-demand lakes: These are known or thought to have considerable fishing pressure, given their size or habitat limitations or sensitive species. They may be high-use now, or show potential for future use.

In southern areas, many lakes have historically been monitored to determine over-wintering conditions and results of fish stocking. This demonstrated the importance of angler interests and guided provincial hatchery plantings. A program of brief, scheduled surveys was maintained, interactions with anglers often occurred on-site, and results were presented at regular stakeholder meetings. Recently, this program is only one of many demands in EcoRegions, and may be modified to fit priorities. It continues to require support such as hatchery stocks and fish ageing services. In northern areas, most lakes have been monitored only rarely, even when they have commercial net fishing or outfitting.

Objective 4: Monitor for Ecosystem Management and Ecological Health

Monitoring of biota in lakes and rivers to establish trends should be a component of any ecosystem monitoring and ecological health indicators.

The usual approach is to choose biological indicators to represent important aspects of fisheries, fish communities, or watersheds. Monitoring would occur on selected lakes to represent:
- a variety of lakes and species and communities,
- different kinds of fishing (sport, commercial, or aboriginal), and
- range of habitat conditions.

This approach requires considerable understanding of ecosystems and leading-edge skills (typically from academic experts), and may explain patterns without contributing directly to management. Long-term studies also require periodic fieldwork, with consistent but adaptable methods. Similar programs in Ontario, Quebec, Wisconsin, and other areas were often historically associated with academic or research institutes.

Indicator lakes: Selection of indicator lakes should ensure coverage of aquatic species, watersheds, or lakes which are known to be under-represented in other surveys. Some re-balance appears necessary in the context of ecosystem monitoring, because large lakes with preferred species have historically been over-represented in surveys.

When changes are noticed in ecosystems, further studies would focus on specific effects or processes. Examples include the incursion of new aquatic species, or the response of so-called prey species to intensive fishing of predators. These studies may only be undertaken when indicators show there are problems.

Issue: Development of the program for ecological health indicators is described in the departmental report "Ecosystem management action plan". Fisheries assessment work will contribute to this program.

Objective 5: Support initiatives regarding Aboriginal conservation

Improve provincial knowledge of aboriginal harvests and cultural aspects.

Various approaches to better understanding of aboriginal fishing include:
- use of Treaty licence questionnaires (similar to sport-fish surveys).
- co-operative studies with Treaty and other Aboriginal organizations.
- contracting surveys to First Nations and/or consultants.
- designing surveys for implementation by other agencies or groups.

Issue: Provincial efforts on Aboriginal fish-harvest surveys have been rare, although experience has been gained in a few cases. Co-operation with Aboriginal groups, institutes, or consultants with experience and credible staff is required. Recent co-operative projects on wildlife usage in the central area of the province are useful examples.

Objective 6: Applied Research and New Methods

Evaluation of previous approaches and adoption of efficient new methods is needed to ensure science-based assessment.

Advantages of new technologies and methods:
- New technology (such as hydro-acoustics or video) should improve field surveys.
- Alternative methods (e.g. trap-nets or electro-shocking) should be less lethal to fish.

Issue: Comparison of new methods with the previous gill-net method should ensure that future data can be used to extend historical trends.

Trap-nets provide data on relative abundance by species with negligible mortality. Hydro-acoustics can estimate absolute abundance of fish in open water. Comparisons over time are needed because all fishing gear has disadvantages, is selective towards some species, and is limited by habitat or other conditions.

RECOMMENDATIONS

Recommendations arising from high-priority issues include:

- Renew the ability to maintain and summarize existing data on harvest and users.
- Support the analysis of fisheries data with software tools and technical advice.
- Expand our ability to collect and summarize data on outfitter and other harvests.
- Commit resources to the Canada-wide survey of anglers in 2000.
- Develop guidelines for reliable and suitable assessments.
- Contribute to the departmental program in ecological health indicators.
- Establish and begin monitoring a series of lakes and fisheries periodically.
- Co-operate in initiatives on understanding Aboriginal usage of fish.
- Develop new methods of monitoring fish abundance and trends.

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APPENDIX A: ASSESSMENT NEEDS AND DELIVERY

Needs

There is a need to co-ordinate provincial policy and legislation, provide provincial guidelines on surveys and methods, compile and maintain long-term and provincial datasets, and advise on specialized issues.

There is also a need for "program delivery", prioritizing assessment and management issues, developing case-studies and reviews for policy decisions, and contributing to province-wide perspectives and long-term monitoring.

Discussions should occur periodically on the prioritization of scientific and management needs, including:

- priorities flowing from departmental objectives (such as annual Corporate Plans), provincial and regional objectives and State of the Environment reports, and long-term ecosystem monitoring projects;
- inventory of existing data and staffing needs for various assessments;
- consensus on reliable methods and new methods for assessment.

Delivery

Objective 1 (Data management):

Maintenance of existing basics requires staff and funding in the Branch and EcoRegions. Expansion of data management requires additional staff.

Objective 2 (Species and co-ordinated):

Existing staff may be targeted to this objective. Funding would be required for periodic angler surveys (as part of catch/effort program) and for software and field-work to model fish populations and user behaviour.

Objective 3 (Regional and co-management):

EcoRegions require biologists and technicians to maintain credible assessments and foster co-operation from resource users.

Objective 4 (Ecosystem monitoring):

Long-term monitoring of fisheries and lakes requires staffing and funds.
Funding and support could come from the departmental ecosystem monitoring program.

Objective 5 (Aboriginal conservation):

Staffing is required for preferred options in this area. In addition, the Commercial Fishing Options Paper (January 2000) has identified additional needs for biological staff.

Objective 6 (New methods):

Implementation of hydroacoustic methods province-wide requires staff and equipment.

APPENDIX B: EXCERPTS FROM OTHER REVIEWS

Some of the issues and recommendations of recent reviews are noteworthy.

National Research Council (1998):

"In an ideal world, accurate and precise estimates of the abundance of fish stocks and their dynamics (how and why population levels change) would be available to set sustainable harvest levels to accommodate commercial and recreational demand. In reality, fishery management is based on imperfect estimation of the number, biomass, productivity, and age structure of fish populations and incomplete knowledge of population dynamics."

"In addition to monitoring the abundance and productivity of exploited fish populations, stock assessments can provide a quantitative prediction of the consequences of possible alternative management actions. The mechanisms that cause fish populations to change are poorly understood but include environmental and ecosystem effects, interactions among multiple species, and effects of humans through harvesting, pollution, habitat disruption, and other factors. ..."

"Stock assessment is a multistage process. Steps include (1) definition of the geographic and biological extent of the stock, (2) choice of data collection procedures and collection of data, (3) choice of an assessment model and its parameters and conduct of assessments, (4) specification of performance indicators and evaluation of alternative actions, and (5) presentation of results."

NMFS (1998):

" ... assessments can be roughly grouped in order of increasing level of complexity into the following categories, each one including features of simpler levels.
Kinds of assessments:

- INDEX: assessment relies on "trends", index of stock size from resource survey data or from fishery catch-per-unit-of-effort (CPUE) data, mean size, landings, and age composition
- YIELD: assessment also includes an evaluation of yield tradeoffs for different levels of fishing mortality and ages of fish caught (e.g. yield-per-recruit analysis)
- AGE STRUCTURE: assessment also includes analysis of the observed age composition of the catch and surveys (e.g. virtual population analysis)

- SPAWNING STOCK: assessment also includes analysis of data on spawning stock size and subsequent recruitment of juveniles and subadults and rations of unfished to fished reproductive potential of stocks
- PREDICTIVE: assessment also includes a model for future stock conditions that accounts for variations in the environment and future recruitment and exploitation rates. ... "

Convention on Biological Diversity, June 1992.

"... In response to the concern over the continued worldwide loss of plant and animal species and habitats, the Convention on Biological Diversity was signed by Canada at the June 1992 Earth Summit in Brazil and ratified in December 1992... The completed strategy was released in November 1995 and received Ministerial endorsement from all jurisdictions in April 1996.

... All federal, provincial and territorial governments are now committed to five goals:
i) Conserve biodiversity and use biological resources in a sustainable manner.
ii) Improve our understanding of ecosystems and increase our resource management capability.
iii) Promote an understanding of the need to conserve biodiversity and use biological resources in a sustainable manner.
iv) Maintain or develop incentives and legislation that support the conservation of biodiversity and the sustainable use of biological resources.
v) Work with other countries to conserve biodiversity, use biological resources in a sustainable manner and share equitably the benefits that arise form the utilization of genetic resources. ..."

Saskatchewan's Biodiversity Action Plan is under development (see SERM 1999).

APPENDIX C: SASKATCHEWAN LAKES AND FISHERIES

In several areas, we have referred to fisheries, lakes, or areas which are important for assessment and monitoring. We have avoided listing specifics, although an understanding of the various considerations and potential candidates would be worthwhile.

The terms used should convey something of the intent, but other terms may be better.

1. Legacy (or heritage) fisheries and lakes are those of historical and recent regional or provincial importance, based on their long-term subsistence use, economic importance, and recurrent issues of sustainability or allocation.

Candidates include long-term fisheries, lakes with demonstrated sustainability (or signs of over-harvests), or lakes with prior surveys or data of species composition, fish sizes, and other trends.

2. High-demand lakes are perceived or known to have considerable fishing for their size or conditions (e.g. habitat limitations, species communities), based on best available information on historical and future uses. The term "high use" is not quite the same, since it implies active usage and actual information on harvests.

Candidates include lakes of high-interest, known or potential high harvests, or sensitive species.

3. Indicator (or ecosystem) lakes and rivers are selected to ensure that monitoring covers all useful situations. These lakes may represent all provincial ecosystems, including fished and non-fished areas, a variety of habitat conditions, various watersheds and size classes of lakes, and permanent or intermittent waterbodies, etc. The objectives in selection may include statistical representation to allow extrapolation of results, or optimal understanding of ecosystem processes, or simply to ensure that a greater variety of situations are monitored.

Candidates may include lakes with non-harvested fish species, under-represented small and very small lakes, isolated and headwater lakes, specimens from secondary and tertiary watersheds, and other factors.